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REMARKS

This paper is being presented in response to the final official action dated November 29, 2005, wherein: (a) claims 1-18 are pending; (b) claims 1-9 have been allowed; (c) claims 10-18 have been rejected under 35 USC § 112, ¶ 1, as lacking written description; (d) claims 10-18 have been rejected under 35 USC § 112, ¶ 2, as being indefinite; (e) claims 10-12 and 14-18 have been rejected under 35 USC § 103(a) as being obvious over U.S. Patent No. 5,998,278 ("Yu") in view of U.S. Patent No. 6,589,879 ("Williams") and U.S. Patent Application Publication No. 2003/0022458 ("Koh"); and, (f) claim 13 has been rejected under 35 USC § 103(a) as being obvious over Yu in view of Williams and Koh and further in view of U.S. Patent No. 6,461,937 ("Kim"). Reconsideration and withdrawal of the rejections are respectfully requested in view of the foregoing amendments and following remarks.

This paper also is being presented within two months of the date of mailing of the final office action.

This paper also is being presented in accordance with 37 CFR § 1.116(b)(1) and (b)(2) in an effort to place the application in condition for allowance. The amendments presented herein were not presented in prior communications to the U.S. Patent and Trademark Office (PTO) due to the applicant's good faith belief that all prior objections/rejections had been overcome by amendment and/or argument. Further, the amendments and arguments presented herein could not have been presented earlier, as they are in response to rejections presented in the most recent, final office action.

The applicant hereby acknowledges, with appreciation, the indication that claims 1-9 are allowed.

II. Submittal of Priority Documents

The applicant thanks the examiner for acknowledging the claim for foreign priority based on applications 2002-84281 and 2002-65753 filed in the Republic of Korea. Certified copies of these applications will be submitted shortly.

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III. Brief Summary of the Amendments to the Claims

A. Claim 10

Claim 10 has been amended to improve clarity and to provide antecedent basis for all recited features.

Specifically, claim 10 recites that the semiconductor substrate defines "an isolation region and an active region." Support for this amendment is found, for example, in the specification at page 1, lines 12-15.

Claim 10 also recites the step of "forming a trench at the central portion of the isolation region." It is apparent that this step was inadvertently omitted from the claim as rejected because claim 10 as filed includes the step of "forming an insulating material layer on the entire structure to bury a trench." Support for this amendment is found, for example, in the specification at page 8, line 21 to page 9, line 15.

Finally, the phrase "wherein the width of the top of the isolation film is widened up to an active region in the semiconductor substrate" has been clarified by amendment to: "wherein the top surface of the isolation film protrudes higher than the active region of the semiconductor substrate." Support for this amendment is found, for example, in the specification at page 10, line 18 to page 11, line 3. Specifically, with reference to Fig. 2g, "the height of the remaining amorphous silicon layer 203 determines the height of the isolation film that is protruded higher than the surface of the semiconductor substrate" once the amorphous silicon layer 203 has been removed. Specification at page 10, lines 22-24.

B. Claim 16

Claim 16 has also been amended to improve clarity and to provide antecedent basis for all recited features.

Specifically, claim 16 recites "a hard mask film" as a component of the initial stack and as a component subsequently removed. It is apparent that this structure was inadvertently omitted from the claim as rejected because claim 16 as filed includes the step of "burying the trench with an insulating film and then removing the hard mask film," but erroneously recited an "anti-reflection film" in the initial stack formation step. Support for this amendment is found in the specification at page 11, lines 11-12 and page 14, lines 17-18.

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Claim 16 also recites that the semiconductor substrate defines "an isolation region and an active region." Support for this amendment is found, for example, in the specification at page 1, lines 12-15.

Amended claim 16 clarifies that the trench is located "at the central portion of the isolation region." Support for this amendment is found, for example, in the specification at page 13, lines 18-21, as well as Figs. 3b and 3c.

Finally, the phrase "wherein the width of the top of the isolation film is widened up to an active region in the semiconductor substrate" has been clarified by amendment to: "wherein the top surface of the isolation film protrudes higher than the active region of the semiconductor substrate." Support for this amendment is found, for example, in the specification at page 16, lines 1-16. Specifically, with reference to Fig. 3h, the isolation film comprises the field oxide film 308, and "the field oxide film 308 formed through the present embodiment is formed higher than the active region" of the substrate. Specification at page 16, lines 11-15.

C. Other Claims

Claims 11-15, 17, and 18 have been amended for clarity and to provide proper antecedent bases where appropriate. The scope of the claims is unchanged.

No new matter has been introduced by the foregoing amendments.

IV. The 35 USC § 112, ¶¶ 1 and 2, Rejections Are Moot or Traversed

Claims 10-18 have been rejected under 35 USC § 112, ¶ 1, as allegedly failing to comply with the written description requirement. See the action at p. 5. Claims 10-18 have also been rejected under 35 USC § 112, ¶ 2, as being indefinite. See the action at p. 6. A response to the rejection is set forth below.

The action indicates that the phrase "forming an isolation film, wherein the width of the top of the isolation film is widened up to an active region in the semiconductor substrate" recited in claims 10 and 16 is unclear with respect to its meaning and its support in the specification. See the action at pp. 5-6. As indicated above, this phrase has been amended, with full support from the specification, to recite "forming an isolation film, wherein the top surface of the isolation film protrudes higher than the active region of the semiconductor substrate." It is respectfully submitted that this phrase is unambiguous and clearly describes, for example, the semiconductor devices shown in Figs. 2i and 3h.

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Further, this amended phrase clarifies that the examiner's understanding of the term is not the intended meaning. Specifically, the phrase does not mean that "the width of the top is wider than the width of the bottom of the insulating film." See the action at p. 6.

Additionally, as indicated above, all claims 10-18 have been amended for clarity and to provide proper antecedent basis where required.

It is respectfully submitted that the application as filed and the claims as amended are in compliance with § 112, ¶¶ 1 and 2, such that the rejections, upon reconsideration, should be withdrawn. Accordingly, reconsideration and withdrawal of the rejections are respectfully requested.

V. The 35 USC § 103(a) Rejections Are Traversed

Claims 10-18 have been rejected under 35 USC § 103(a) as being obvious over the Yu in view of Williams and Koh, and further in view of Kim in the case of claim 13. A response to the obviousness rejection is set forth below.

A. Proper Basis for a § 103(a) Rejection

To establish a *prima facie* case of obviousness, the PTO must satisfy three basic criteria. First, the combined disclosure of the prior art references must teach or suggest all of the claim limitations. Second, there must be some suggestion or motivation to modify or combine the teachings in the art to make the precise combination recited in the claims. Finally, a person having ordinary skill in the art must have a reasonable expectation of success when combining or modifying the disclosures of the references. The suggestion or motivation to make the claimed invention and the reasonable expectation of success must both be derived from the prior art, and not from the application's disclosure. See MPEP §§ 2142-43 (8th ed., August 2005).

Where obviousness is alleged to arise from a combination of elements across a plurality of references, the PTO must show the existence of some suggestion, motivation, or teaching to those skilled in the art to make the precise combination recited in the claims. See *Iron Grip Barbell Co. v. USA Sports, Inc.*, 392 F.3d 1317, 1320 (Fed. Cir. 2004). Specifically, the PTO must explain why the prior art would have suggested to one of ordinary skill in the art the desirability of the modification. *Id.*; *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998) ("In other words, the examiner must show reasons that the skilled artisan, confronted with the same

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problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination." Evidence of a suggestion or motivation to combine prior art references may come from "the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem to be solved." *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1125 (Fed. Cir. 2000). However, a disclosure that "criticize[s], discredit[s], or otherwise discourage[s] the solution claimed in [an] application" can support a finding that the prior art teaches away from the applicant's claim. See *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004).

**B. No Prima Facie Case of Obviousness Has Been Made
and, therefore, the § 103(a) Rejection Is Traversed**

Because independent claims 10 and 16 recite the formation of an isolation film "wherein the top surface of the isolation film protrudes higher than the active region of the semiconductor substrate," no *prima facie* case of obviousness exists based on the combination of the applied publications. Specifically, Yu, Williams, Koh, and Kim *do not* teach or suggest the combination of features recited in independent claims 10 and 16. Claims 11-15, 17, and 18 depend from these independent claims; therefore, the applied references also fail to teach the combination of features recited therein. Furthermore, there is no motivation to modify the combination of Yu, Williams, Koh, and Kim in a way to yield the claimed invention.

Yu discloses a method of fabricating shallow trench structures using an oxidized polysilicon trench mask. Yu discloses the formation of a layered structure containing a pad oxide, a polysilicon layer, a silicon nitride layer, and a photoresist layer on a substrate. Yu, at col. 2, lines 48-58 and Figs. 2a and 2b. A combination of etching, oxide formation, and polishing steps are used to form a shallow trench isolation structure. See *generally*, Yu, at cols. 2-3. Notably, the top surface of the isolation oxide layer 27a does not extend above the surface of the neighboring substrate, and thus "an even surface of the substrate without recess is provided." Yu, at col. 3, lines 46-47 and Fig. 2g. Therefore, Yu does not disclose an isolation film "wherein the top surface of the isolation film protrudes higher than the active region of the semiconductor substrate."

Williams discloses a nitride open etch process based on trifluoromethane and sulfur hexafluoride. More specifically, the nitride etch process is used to form a

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sloping sidewall surface in the trench of a shallow trench isolation structure. Williams, at abstract; col. 3, lines 26-28; and, Fig. 2. Williams does not apparently disclose the filling of the trench with an isolation film.

Koh discloses a method of forming a shallow trench isolation in a semiconductor structure. Koh discloses the formation of a layered structure containing a first oxide layer, a silicon layer, and a photoresist layer on a semiconductor substrate. Koh, at ¶ 25 and Fig. 2A. A combination of etching, oxide formation, and polishing steps are used to form an intermediate shallow trench isolation structure. *See generally*, Koh, at ¶¶ 25-38 and Fig. 2D. A third oxide layer 22B is shown extending above the layer of the substrate 21 in Fig. 2D. However, this structure is not analogous to the recited structure in claims 10 and 16. Specifically, the recited structure in claim 10 is formed by "removing the amorphous silicon layer," and the structure of claim 16 is formed by "etching the amorphous silicon layer and the pad oxide film below the oxide film on the side of the amorphous silicon layer." The silicon layer 23 shown in Fig. 2D has been subject to a polishing process, but has been neither removed nor etched as recited in claims 10 and 16. Koh, at ¶ 28. Koh does not apparently disclose any further processing steps.

Kim discloses methods of forming trench isolation regions having recess inhibiting layers therein that protect against overetching. Kim discloses the formation of a layered structure containing a pad oxide and a silicon nitride layer on a substrate. Kim, at col. 5, lines 38-59 and Fig. 6. A combination of etching, oxide formation, and polishing steps is used to form a shallow trench isolation structure. *See generally*, Kim, at cols. 5-7. Notably, the top surface of the trench isolation layer 114 does not extend above the surface of the neighboring substrate. Kim, at Fig. 10; *see also* Kim, at Figs. 17, 21, and 24 (showing alternate embodiments having trench isolation layers that do not extend above the surface of the neighboring substrate). Therefore, Kim does not disclose an isolation film "wherein the top surface of the isolation film protrudes higher than the active region of the semiconductor substrate."

Moreover, there is no motivation to modify the combination of Yu, Williams, Koh, and Kim to include the formation of an isolation film "wherein the top surface of the isolation film protrudes higher than the active region of the semiconductor substrate." Yu, Koh, and Kim disclose prior art configurations in which a *portion* of a trench oxide layer extends above the level of the semiconductor substrate. *See* Yu, at Fig. 1E; Koh, at Fig. 1D; and, Kim, at Fig. 30E. However, these structures show

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recessed structures that descend below the level of neighboring substrate active areas. See Yu, at Fig. 1E ("recess 17"); Koh, at Fig. 1D ("recess area 14"); and, Kim, at Fig. 30E. These undesirable recessed structures are precisely the structures Yu, Koh, and Kim are directed toward eliminating. See Yu, at col. 2, lines 14-19; Koh, at ¶¶ 8 and 13; and, Kim, at col. 3, lines 44-47. More specifically, Yu states that:

It is accordingly an object of the present invention to provide a polysilicon layer before forming a masking layer. The polysilicon layer is oxidized to become an [sic] silicon oxide layer after etch back. *An even surface of the substrate without a recess is obtained.* Therefore, the kink effect is prevented, and the reliability of the devices is enhanced.

Yu, at col. 2, lines 14-19 (emphasis added). Thus, there is no motivation to modify the combination of Yu, Williams, Koh, and Kim in the manner recited in claims 10 and 16, because the only disclosures of structures even similar to the claimed structures (i.e., the prior art structures disclosed by Yu, Koh, and Kim) relate to undesirable structures that the Yu, Koh, and Kim propose to remedy. See *In re Fulton*, 391 F.3d at 1201.

Additionally, the recessed structures shown in Yu, Koh, and Kim do not satisfy the recited formation of an isolation film "wherein the top surface of the isolation film protrudes higher than the active region of the semiconductor substrate," because a portion of the top surface of their trench oxide layers is below the neighboring active region. See Yu, at Fig. 1E; Koh, at Fig. 1D; and, Kim, at Fig. 30E.

Thus, Yu, Williams, and Koh do not teach or suggest the combination of features recited in claims 10-12 and 14-18. Additionally, Yu, Williams, Koh, and Kim do not teach or suggest the combination of features recited in claim 13. Further the addition of Kim to the combination of Yu, Williams, and Koh does not remedy the lack of teaching with respect to claims 10-12 and 14-18.

Prima facie obviousness under § 103 is a legal conclusion — not a fact. *In re Rinehart*, 531 F.2d at 1052. The foregoing response identifies facts (e.g., evidence in the form of statements in the prior art) rebutting the alleged legal conclusion that the claimed invention is prima facie obvious. All of these facts must be evaluated along with the facts on which the legal conclusion was originally reached — not the legal conclusion itself. Having requested herein reconsideration of the legal conclusion set forth in the official action, the PTO is obligated to address all of the

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evidence and base its forthcoming legal conclusion(s) on such evidence, uninfluenced by its earlier conclusions. *Id.*

Given these shortcomings, it is respectfully submitted that the claimed invention is unobvious. Accordingly, reconsideration and withdrawal of the rejection are requested.

CONCLUSION


In view of the foregoing, entry of the amendments to claims 10-18, reconsideration and withdrawal of the rejections, and allowance of all pending claims 1-18 are respectfully requested.

Should the examiner wish to discuss the foregoing, or any matter of form or procedure in an effort to advance this application to allowance, the examiner is urged to contact the undersigned attorney.

Respectfully submitted,

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